



NIRB Application for Screening #125690

Shipping Emissions in the Arctic and North Atlantic Atmosphere

Application Type: New

Project Type: Scientific Research

Application Date: 4/26/2022 1:51:13 PM

Period of operation: from 0001-01-01 to 0001-01-01

Proposed Authorization: from 0001-01-01 to 0001-01-01

Project Proponent: Zongbo Shi
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DETAILS

Non-technical project proposal description

- English: The research cruise we are proposing is part of a UK Natural Environment Research Council funded project – “Shipping Emissions in the Arctic and North Atlantic Atmosphere: SEANA”. The project is hosted by the University of Birmingham and led by Professor Zongbo Shi. Ship emissions have a marked influence on the concentrations of aerosol particles in the marine atmosphere. These tiny particles affect the climate by scattering light back to space and by forming clouds. Melting sea ice in the Arctic in the future will lead to increased shipping in the region, which could significantly affect the atmospheric composition and climate. Quantifying these influences is challenging, however, due to a lack of understanding of marine aerosol sources (a dynamic baseline from which predictions are made) as well as uncertainty in current / future shipping emissions. This is particularly true at high-latitudes. SEANA aims to better understand the impact of increasing future ship traffic upon atmospheric aerosol particles and the climate in western Arctic. To this aim, we first have to better understand where are the aerosol particles coming from and how they are formed or change in the Arctic atmosphere. These data are essential to improve global models, which are poor at modelling Arctic aerosol particles. For this reason, SEANA project will organize a research cruise to the David Strait, Labrador Sea and potentially South Baffin Bay (if sea ice melted during the cruise). We will use the UK’s Royal Research Ship Discovery for this cruise. She will sail from Iceland on 19 May and back to the UK on 27 June 2022. The research will involve 19 scientists onboard and supported by 29 crew and technicians. During the research cruise, we will make a comprehensive observation of physical and chemical properties of aerosol particles, as well as on cloud condensation and ice nuclei (which form clouds). After the cruise, we will analyse the new data to quantify the sources of aerosol particles in the region (e.g., from biomass burning, mineral dust, or shipping) and understand the chemical processes affecting the ability of the particles to form clouds. The new datasets and process understanding will be used to evaluate and improve a state-of-the-art global aerosol model to represent key aerosol sources and processes, including shipping emissions. SEANA will apply the improved model to provide robust predictions on both the impact of future ship traffic on aerosol and the climate in the western Arctic. This will inform future policies to limit shipping emissions to protect the Arctic environment, which may be highly sensitive to shipping emissions. This research cruise will primarily focus on the areas where the ice is melting. We also plan to sail to eastern coast of Canada, if sea ice conditions permitting, in order to measure the aerosol particles (including for example, biomass burning and mineral dust) from the North American continent.
- French: La croisière de recherche que nous proposons fait partie d'un projet financé par le Conseil de recherche sur l'environnement naturel du Royaume-Uni - Émissions maritimes dans l'atmosphère arctique et nord-atlantique : SEANA. Le projet est hébergé par l'Université de Birmingham et dirigé par le professeur Zongbo Shi. Les émissions des navires ont une influence marquée sur les concentrations de particules d'aérosols dans l'atmosphère marine. Ces minuscules particules affectent le climat en diffusant la lumière vers l'espace et en formant des nuages. La fonte des glaces de mer dans l'Arctique à l'avenir entraînera une augmentation de la navigation dans la région, ce qui pourrait affecter considérablement la composition atmosphérique et le climat. La quantification de ces influences est difficile, cependant, en raison d'un manque de compréhension des sources d'aérosols marins (une base dynamique à partir de laquelle les prévisions sont faites) ainsi que de l'incertitude des émissions actuelles / futures du transport maritime. Cela est particulièrement vrai aux hautes latitudes. SEANA vise à mieux comprendre l'impact de l'augmentation future du trafic maritime sur les particules d'aérosols atmosphériques et le climat dans l'ouest de l'Arctique. Pour cela, nous devons d'abord mieux comprendre d'où viennent les particules d'aérosols et comment elles se forment ou se modifient dans l'atmosphère arctique. Ces données sont essentielles pour améliorer les modèles globaux, qui sont peu capables de modéliser les particules d'aérosols arctiques. Pour cette raison, le projet SEANA organisera une croisière de recherche dans le détroit de David, la mer du Labrador et potentiellement le sud de la baie de Baffin (si la glace de mer a fondu pendant la croisière). Nous utiliserons le Royal Research Ship Discovery du Royaume-Uni pour cette croisière. Elle quittera l'Islande le 19 mai et reviendra au Royaume-Uni le 27 juin 2022. La recherche impliquera 19 scientifiques à bord et sera soutenue par 29 membres d'équipage et techniciens. Au cours de la campagne de recherche, nous ferons une observation complète des propriétés physiques et chimiques des particules d'aérosols, ainsi que de la condensation des nuages et des noyaux de glace (qui forment les nuages). Après la croisière, nous analyserons les nouvelles données pour quantifier les sources de particules d'aérosols dans la région (par exemple, la combustion de la biomasse, la poussière minérale ou le transport maritime) et comprendre les processus chimiques affectant la capacité des particules à former des nuages. Les nouveaux ensembles de données et la compréhension des processus seront utilisés pour évaluer et améliorer un modèle mondial d'aérosols à la pointe de la technologie afin de représenter les principales sources et processus d'aérosols, y compris les émissions des navires. SEANA appliquera le modèle amélioré pour fournir des prédictions robustes à la fois sur l'impact du futur trafic maritime sur les aérosols et sur le climat dans l'ouest de l'Arctique. Cela éclairera les politiques futures visant à limiter les émissions du transport maritime afin de protéger l'environnement arctique, qui peut être très sensible aux émissions du transport maritime. Cette croisière de recherche se concentrera principalement sur les

zones où la glace fond. Nous prévoyons également de naviguer vers la côte est du Canada, si les conditions de glace de mer le permettent, afin de mesurer les particules d'aérosols (y compris, par exemple, la combustion de la biomasse et la poussière minérale) en provenance du continent nord-américain.

Inuktitut: Not applicable. No impact on the local communities

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Personnel

Personnel on site: 48

Days on site: 35

Total Person days: 1680

Operations Phase: from 2022-05-20 to 2022-06-25

Activities

Location	Activity Type	Land Status	Site history	Site archaeological or paleontological value	Proximity to the nearest communities and any protected areas
South Baffin / David Strait	Scientific/International Polar Year Research	Marine	Not being studied before	Not relevant	Far away from the protected areas / communities
David Strait	Scientific/International Polar Year Research	Marine	None	None	Far away from the communities and protected area; considering the thick sea ice and RRS Discovery can only work in 1/10 sea ice and open water, the research area will be much limited and will likely to be very far away from the land
Proposed ship track - David Strait, South Baffin and Labrador Sea	Scientific/International Polar Year Research	Marine	None	None	Considering the thick sea ice and RRS Discovery can only work in 1/10 sea ice and open water, the research area will be much limited and will likely to be very far away from the land

Community Involvement & Regional Benefits

Community	Name	Organization	Date Contacted
Information is not available			

Authorizations

Indicate the areas in which the project is located:

Transboundary
South Baffin

Authorizations

Regulatory Authority	Authorization Description	Current Status	Date Issued / Applied	Expiry Date
Information is not available				

Project transportation types

Transportation Type	Proposed Use	Length of Use
Water	Royal Research Ship Discovery	

Project accomodation types

Other,

Material Use

Equipment to be used (including drills, pumps, aircraft, vehicles, etc)

Equipment Type	Quantity	Size - Dimensions	Proposed Use
Research Ship RRS Discovery	1	96 m long	To carry out scientific research on the sources of airborne particles that are important for the clouds and climate in the Arctic
Sea containers for hosting scientific instruments	3	2.4 * 2.6*6.1 m	Measure the chemical composition and physical properties of airborne particles and gaseous pollutants
Airborne particle samplers	12	05*0.5*1.5m	To collect airborne particles for offline chemical composition analyses
Aerosol analysers	30	0.8*1*1.2m	Measure the chemical composition and physical properties of airborne particles
Gas analysers	20	0.5*0.5*1m	To measure the concentrations of various gases in the air

Detail Fuel and Hazardous Material Use

Detail fuel material use:	Fuel Type	Number of containers	Container Capacity	Total Amount	Units	Proposed Use
Chemical - acids	hazardous	3	1	3	Liters	Chemical reagents for research
chemicals - organic solvents	hazardous	6	2	12	Liters	For use within different instruments
Diesel	fuel	14	14	196	Cubic Meters	low sulphur fuel
chemicals - bases / neutral	hazardous	8	1	8	Kg	For use in the lab

Water Consumption

Daily amount (m3)	Proposed water retrieval methods	Proposed water retrieval location
0	Directly pumping seawater through an underway pump to the laboratory. The amount of water we will use is minimal - we will take a very small amount of water to measure water chemistry.	Water samples will be taken along the research cruise track (which is shown in the project map).

Waste

Waste Management

Project Activity	Type of Waste	Projected Amount Generated	Method of Disposal	Additional treatment procedures
Scientific/International Polar Year Research	Combustible wastes	500 kg	incinerated at sea	N/A
Scientific/International Polar Year Research	Greywater	3000kg	Stored and disposed when back to the UK (Southampton port)	N/A
Scientific/International Polar Year Research	Hazardous waste	50 kg	Safely stored on the ship and disposed appropriately when returned to the UK (Southampton port)	N/A
Scientific/International Polar Year Research	Non-Combustible wastes	5000kg	Stored and disposed of upon arrival in Southampton port in the UK	N/A
Scientific/International Polar Year Research	Sewage (human waste)	1500kg	Stored safely onboard and disposed when back to the UK (Southampton port)	N/A

Environmental Impacts:

The ship will release air pollutants from the fuel burning. The impact is negligible due to the huge air volume in the study area. Chemicals: All chemicals will have accompanying COSHH and risk assessments. They will be stored, handled and disposed of appropriately as per standard NMF procedure. Ship's waste: All cardboard and paper products are incinerated at sea on the Discovery. Recyclable items are stored for appropriate recycling upon arrival into port. Any non-burnable or non-recyclable waste (e.g. batteries) is stored appropriately and disposed of upon arrival into port. Incidental waste: It is intended that all equipment will be recovered. Acoustic-based data collection The potential impacts associated with acoustic data collection relate to marine mammals. The primary concerns to marine mammals as a result of acoustic systems are considered to be masking effects, behavioural changes, and physiological effects such as temporary threshold shift (TTS) and permanent threshold shift (PTS). While it is difficult to be certain of the potential for physiological damage as a result of various acoustic activities, localised behavioural disturbance is considered a possibility. These concerns are considered below. Deep-water multibeam echosounder: The effects of multibeam echosounders on marine mammals has not been widely studied, such that it is unclear what impacts these may have on them. While Lurton and DeRuiter (2011) suggested that the risk of the sounds causing physiological auditory damage to marine mammals is likely to be low, a few studies have observed potential behavioural changes as an apparent result of the operation of multibeam echosounders (Quick et al 2016; Cholewiak et al 2017). Due to this uncertainty, the JNCC have created a set of best-practice guidelines to follow in the case of deep-water multibeam echosounder surveys (see MEMP). With the proposed mitigation recommendations outlined in the MEMP, the effects of the multibeam echoso

Additional Information

SECTION A1: Project Info

SECTION A2: Allweather Road

SECTION A3: Winter Road

SECTION B1: Project Info

SECTION B2: Exploration Activity

SECTION B3: Geosciences

SECTION B4: Drilling

SECTION B5: Stripping

SECTION B6: Underground Activity

SECTION B7: Waste Rock

SECTION B8: Stockpiles

SECTION B9: Mine Development

SECTION B10: Geology

SECTION B11: Mine

SECTION B12: Mill

SECTION C1: Pits

SECTION D1: Facility

SECTION D2: Facility Construction

SECTION D3: Facility Operation

SECTION D4: Vessel Use

SECTION E1: Offshore Survey

SECTION E2: Nearshore Survey

SECTION E3: Vessel Use

SECTION F1: Site Cleanup

SECTION G1: Well Authorization

SECTION G2: Onland Exploration

SECTION G3: Offshore Exploration

SECTION G4: Rig

SECTION H1: Vessel Use

SECTION H2: Disposal At Sea

SECTION I1: Municipal Development

Description of Existing Environment: Physical Environment

This research will primarily be on air composition. The ship will sail in open water with no sea ice or less 1/10 of sea ice. Air quality in the area is usually predicted to be extremely clean and that is the reason we are studying it. We expect that in the future when there are more ships, the emissions from the ships could significantly affect the sensitive Arctic environment and climate. It is predicted that sea ice will be completely melted in the summer long the Northwestern Passage. This makes Arctic shipping possible. The single ship we will use will have minimum impact on the noise level in the study area.

Description of Existing Environment: Biological Environment

The research cruise will sail in the David Strait and will be far away from wildlife species

Description of Existing Environment: Socio-economic Environment

Not applicable - no direct engagement identified

Miscellaneous Project Information

Identification of Impacts and Proposed Mitigation Measures

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Cumulative Effects

Impacts on the environment and wildlife is minimal.

Impacts

Identification of Environmental Impacts

	PHYSICAL	Designated environmental areas	Ground stability	Permafrost	Hydrology / Limnology	Water quality	Climate conditions	Eskers and other unique or fragile landscapes	Surface and bedrock geology	Sediment and soil quality	Tidal processes and bathymetry	Air quality	Noise levels	BIOLOGICAL	Vegetation	Wildlife, including habitat and migration patterns	Birds, including habitat and migration patterns	Aquatic species, incl. habitat and migration/spawning	Wildlife protected areas	SOCIO-ECONOMIC	Archaeological and cultural historic sites	Employment	Community wellness	Community infrastructure	Human health
Construction																									
-			-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-		-	-	-	-	-
Operation																									
Scientific/International Polar Year Research			-	-	-	-	-	-	-	-	-	-	N	N		-	-	-	U	-		-	-	-	-
Decommissioning																									
-			-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-		-	-	-	-	-

(P = Positive, N = Negative and non-mitigatable, M = Negative and mitigatable, U = Unknown)

Project Location



List of Project Geometries

- | | | |
|---|----------|---|
| 1 | polygon | South Baffin / David Strait |
| 2 | polygon | David Strait |
| 3 | polyline | Proposed ship track - David Strait, South Baffin and Labrador Sea |